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deduction from our investigation (p. 356), viz. that the true value of u lies between u_0 and u_1, the initial and final values of one of the ordinary calculations, as exhibited at p. 359. For instance, in the present case, the final number (U_2) lies between both pairs, $u_0 - u_1$, and $U_1 - u_2$.

But the value of u given by Klinkerfues (p. 97) as that which would be obtained, "setzen wir die Versuche bis zur grössten Schärfe fort," is 0·24389, which falls beyond the limits $U_1 - u_2$ by four units of the last place. Here certainly either my theory was wrong, or my computation of $U_1 - u_2$ was wrong, or Klinkerfues was wrong. I believe, after a good deal of troublesome verification, that Klinkerfues' value is wrong upon the data assumed.

I think there can be no question that the present method gets over one of the most troublesome and unsatisfactory parts of the computation of parabolic orbits better than any method in common use.

Observations of the Companion of α Canis Majoris with the Transit Circle of the U.S. Naval Observatory. By J. R. Eastman, Esq.

Date.	Object.	Seconds of Transit.	Micrometer Readings.	Δα	Δδ	p	s
		s		s	r	°	″
March 20	*α Canis Majoris*	11·362	33·070	0·622	0·502	49·3	11·8
	Companion	11·984	32·568				
,, 22	*α Canis Majoris*	10·965	33·235	0·631	0·415	55·0	11·1
	Companion	11·596	32·820				
,, 23	*α Canis Majoris*	10·910	33·235	0·644	0·420	55·2	11·3
	Companion	11·554	32·815				

One revolution of the micrometer screw = 15″·312.

The transit of *α Canis Majoris* was observed over *six* threads and the companion over *five* threads. On March 20 both stars were unusually steady, and the observations of the difference of declination were much better than on the other nights.

Of course these observations have but little value in fixing the position of the companion, and are given only to show that it *may* be observed on a meridian instrument of 8·5 inches aperture.

Naval Observatory, Washington,
March 25, 1878.

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English Observations of the Satellites of Mars, 1877.

The following communications relating to the English observations of the satellites of *Mars* are those referred to in the Report of the Council at the general meeting of February last, see p. 209.

Observations made at the Royal Observatory, Greenwich.

OUTER SATELLITE.

Date.	h m	Sidereal Time. h m	Position Angle. °	Distance. Radii.	Distance. ″	Observer.	Remarks.
Sept. 5	9 33	20 33	270		60 ±	M.	Rough estimation.
Sept. 5	9 50	20 50	240	4	or 59	M.	Estimation.
Sept. 5	10 33	21 33	230	3¼	or 48	M.	Estimation.
Sept. 5	11 0	22 0	225 ±	4 ±	or 59 ±	W.C.	Rough estimation.
Sept. 19	12 21	0 17	190° to 195°	2	or 28	M.	Very rough est.
Sept. 28	10 36	23 7	110° to 115°	2½	or 33	M.	Estimation.
Sept. 29	8 55	21 30	248° 31′		80″·4	M.	Measure.
Sept. 29	9 10	21 45	255	6	or 77	M.	Estimation.

INNER SATELLITE.

Date.	h m	Sidereal Time. h m	Position Angle. °	Distance. Radii.	Distance. ″	Observer.	Remarks.
Sept. 28	10 21	22 52	280° to 285°	2¼	or 29	M.	Estimation.
Sept. 28	10 41	23 12	285	2½	or 33	M.	Estimation.

In reference to these observations Mr. Christie writes:—

1. My first view of the outer satellite (on August 31, 12^h) was obtained when I was ignorant of its calculated position, being in fact under the impression that it ought to be on the other side of the planet. The other observations were made with a general knowledge of the time of E. or W. elongation, but without any Ephemeris of position angles and distances, so that the observer did not know whether the satellite would be N. or S. of *Mars*.

2. We are quite satisfied of the existence of objects seen distinctly in the approximate positions noted. The motion of the object seen on September 5 for several hours was sufficient to prove it to be a satellite, as it approached *Mars* somewhat, whilst if it had been a star the planet would have approached it by 60″ or 70″ in one and a half hours.* In the case of the inner satellite, the motion was slightly *from* the planet in the course of 20^m, whilst for a star there would have been an *approach* of 6″. No red colour was noticed in the outer satellite. The planet was wholly or partly hidden when observing the satellites. The outer one was well seen when fully half the disk of *Mars* was uncovered.

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* With *increase* of position-angle up to 360°, about.

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Estimated Positions of the Satellites, as observed at the University Observatory, Oxford.

The Outer.				The Inner.			
Date. 1877.	Sidereal Time, Oxford.	Position Angle.	Distance.	Date. 1877.	Sidereal Time, Oxford.	Position Angle.	Distance.
	h m	°	″		h m	°	″
Sept. 8	23 0	69	80				
Oct. 2	21 31	80	80	Oct. 2	21 40	80	32
Oct. 4	22 5	305	61·5				
Nov. 1	22 30	225	30 ±				

In reference to these Professor Pritchard writes that no Ephemeris of the Satellites was used or known at the Observatory.

Outer Satellite of Mars.

Dr. Wentworth Erck writes:

That on September 3, at 23^{h} 0^{m} G.S.T., he most distinctly saw the satellite at position 64°, and continued to watch it at short intervals for a period of two hours, during which time it had moved to position 55°.

That on September 8, at 22^{h} 35^{m} G.S.T., he again saw the satellite at position 78°.

That at this date no Ephemeris of the satellite had been published to his knowledge, and that the first Ephemeris known to him was that in *Nature* of September 13, which had not reached his hands on September 15, on which day he again kept the satellite under observation for a period of nearly four hours, during which the positions were as follows:—

	h	m			°
Sept. 15	21	10	G.S.T.	Pos.	257
„	23	30	„	„	243
16	1	0	„	„	238

That again he kept the satellite under observation from September 25, 22^{h} 20^{m} G.S.T., when the position was 264°, to September 26, 0^{h} 35^{m}, when the position was 255°.

That he again saw the satellite on September 27, 23^{h} 0^{m}, at position 69°, and yet again for the last time on October 2, at 24 hours, when the position was 64°; but it had then become so faint that he had exceeding difficulty in seeing it at all.*

That comparison of the satellite with two stars seen at different times, in the field along with the satellite and in nearly similar positions with regard to the planet, enabled him subsequently to estimate the diameter of the satellite at 13·6 miles, or $\frac{1}{300}$th of the diameter of the planet, assuming the planet and the satellite to reflect light alike.

This satellite was more conspicuous than *Enceladus*, and was on one occasion seen distinctly and steadily with an equilateral triangular aperture whose side was 6 inches.

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* The satellite was never seen at much less than two diameters of the planet from the limb.

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The inner satellite was never seen; but unfortunately during the first half of September, that is to say during the most favourable period, despair of success with the inner satellite concentrated attention on the outer one.

The observations were made with that $7\frac{1}{2}$-inch object glass which Alvan Clarke first sent the late Mr. Dawes. At all times an hexagonal aperture was employed, with single lenses as eye-piece, giving powers of 250 and 300.

Mr. H. C. Key writes:

"I first saw the outer satellite of *Mars* on the night of September 19, at about $9^h\ 30^m$, in the position assigned in the Ephemeris published in *Nature*. I used an 18-inch silvered glass equatoreal Newtonian. With an ordinary negative eye-piece, and a bar in it hiding the planet, I could hardly do more than glimpse the satellite occasionally, owing to the scattered light from *Mars*; but with a concave eye lens giving nearly the same power, 180, I could see the satellite pretty distinctly notwithstanding the brilliancy of the primary. Two or three nights afterwards—I was prevented making a note at the time as several friends were with me—I again saw the satellite with the same eye-piece, having myself calculated its approximate position in the absence of an Ephemeris. I have no doubt whatever in my own mind that the object was a satellite of *Mars*. I looked long and carefully for the inner satellite, but failed to find it.

"Were the opportunity to come over again, I have little doubt that, with a diminished aperture on the telescope—12 inches instead of 18—and a better prepared method of hiding the primary, I should be able to measure the distance and position of this satellite without much difficulty.

Mr. Brett writes:

"I enclose a tracing from the entry in my observing book, which I think comprises all the data I can offer as regards distance and position angle, being only eye estimates, and their accuracy being marred by the bar in the field, which was found necessary in order to conceal the disk of the planet. My bar, however (a minute slip of paper), was partially transparent, and enabled me to judge the distance in semi-diameters with tolerable accuracy.

"You will notice that the recorded observations extend over one hour and twenty minutes, but that only the outer satellite persists through the whole interval. The righthand one of the dots marked in my diagrams was only perceived a little before 10^h, and as its place did not at all accord with the ephemeris of the inner satellite as supplied to me, I have nothing to remark about it, except that, with equally good definition, it was not visible at $9^h\ 20^m$, but I thought it too *far* from the planet for the inner satellite (?).

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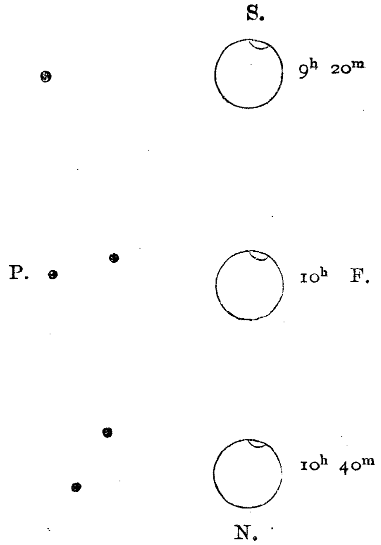
"As regards the outer, the observations were quite free from doubt in my own mind. The point of light was exceedingly minute, but was *not* lost to sight at any time during the interval named.

"I had sought for the satellites on many evenings previously in vain, but the plane mirror had had its silver a good deal worn off. Early in September I procured from Mr. Browning a new plane mirror, and likewise from Greenwich an Ephemeris.



The Ephemeris for September 15 gave greatest elongation of outer satellite at 9^h. On that occasion my new plane mirror mounted, and on placing the telescope on *Mars* I very soon perceived the minute point marked in diagram.

"The second minute point was of about the same brightness as the first. Both died out of sight shortly before $11.^h$

"Aperture of telescope 9′·1, power 380 (by With-Browning.)"

Mr. Marth has compared the foregoing observed places of the outer satellite, and also those of Mr. Common given in the January No., with places computed from approximate elements deduced from some of Professor Asaph Hall's observations.

Greenwich Observations.

					Obs.			Comp.	
					Pos.	Dist.		Pos.	Dist.
		h	m		°	″		°	″
1877	Sept. 5	9	33	G.M.T.	270	60	est.	245·8	82·9
		9	50		240	59	,,	244·6	81·4
		10	33		230	48	,,	241·4	76·9
		11	0		225 ±	59	,,	239·1	73·3
	19	12	21		190° to 195°	28	,,	182·9	28·6
	28	10	36		110° to 115°	33	,,	118·9	34·9
	29	8	55		248° 31′	80·4	meas.	249·11	73·7
		9	10		255°	77	est.	248·0	72·8

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Oxford Observations.

				Obs.		Comp.	
				Pos.	Dist.	Pos.	Dist.
	h	m		°	"	°	"
Sept. 8	23	0	Oxf. Sid. T.	69	80	71·7	85·5
Oct. 2	21	31		80	80	86·3	64·1
4	22	5		305	61·5	253·0	72·3
Nov. 1	22	30		225	30 ±	?	

Dr. Erck's Observations.

	h	m		Obs. °	Comp. °
Sept. 3	23	0	G. Sid. T.	64	65·6
	? 1	0		55	55·6
8	22	35		78	74·2
15	21	10		257	256·5
	23	30		243	247·2
16	1	0		238	267·1
25	22	20		264	266·3
26	0	35		255	322·4
27	23	0		69	72·9
Oct. 2	0			64	76·3

Mr. Brett's Diagrams.

Sept. 15	9	20	G.M.T.	?	257·2	6·8 rad.
	10				254·5	6·9
	10	40			251·9	6·9

Mr. Common's Observations.

	h	m		Obs. °	'	Comp. °
Sept. 11	9	52	G.M.T.	270		291·3
15	10	15		253	48	253·53
	10	20		252	44	253·20
	10	41		251	2	251·83
	10	47		250		251·5
	10	50		250	40	251·24
	12	43		244	28	243·28
	12	51		240	40	242·62
	13	5		243		241·5
16	12	43		273		273·0
	12	47		269		272·5
	12	50		273	30	272·07
	12	57		270		271·2

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			Obs.			Comp.	
	h	m	°		″	°	″
	13	5			63·2		62·8
	13	44	266	4		266·28	
	13	50			72·1		69·8
	13	58	263	4		264·99	
	14	0	263	36		264·81	
	14	5	264	8	75·6	264·38	71·9
21	8	34	62	8		32·93	
24	8	49	240	30		243·84	
	9	8	236	30		242·24	
28	11	23	111			131·5	
29	9	28	244	30		246·69	
	9	33	245	45		246·30	
	10	29	242			241·64	
	10	36	239	3		241·18	
30	10	28	269	30		271·51	
	10	38	267	30		270·60	
	10	52	267	0		268·93	
	11	0	266			268·14	

Note on the Table, p. 70 of Vol. II. Dun Echt Observatory Publications. By Lord Lindsay.

There is in the description of the table an ambiguity, which may be cleared up thus:

In taking out N from the tables the sign is to correspond to the sign of the cosine of the Hour Angle for Latitude North, and the opposite sign for Latitude South

The sign of M is immaterial, as Z is always positive.

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